

REMARKS/ARGUMENTS

Favorable consideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1, 4-6, 10 and 12-16 are presently pending in this application, Claims 1, 6, and 16 have been presently amended.

In the outstanding Office Action, the specification was objected to as failing to provide an adequate written description and as failing to provide an enabling disclosure; Claims 1, 4-6 and 10-16 were rejected under 35 U.S.C. §101, as containing subject matters rendered inoperative and lacking utility; Claims 1, 4-6 and 10-16 were rejected under 35 U.S.C. §112, first paragraph, as containing subject matter lacking adequate written description and not enabling to one skilled in the relevant art; Claims 1, 4-6 and 10-16 were rejected under 35 U.S.C. §112, second paragraph, for being indefinite; Claims 1, 4-6 and 10-16 were rejected under 35 U.S.C. §102(b) as being anticipated by Iwamura et al. (*Detection of Anomalous elements, x-rays, and excess heat induced by continuous diffusion of deuterium through multilayer cathode (Pd/CaO/Pd)*); Claims 1, 4-6 and 10-16 were rejected under 35 U.S.C. §102(a) as being anticipated by JP 2000-042388 (hereinafter “JP ‘388”); and Claims 1, 4-6 and 10-16 were rejected under 35 U.S.C. §103(a) as being unpatentable over JP ‘388 in combination with JP 2000-258573 (hereinafter “JP ‘573”).

Claim Summary: Claim 1 as currently amended is directed to a nuclide transmutation device including:

1) a structure body including a hydrogen absorbing material which is at least one of a hydrogen absorbing metal and a hydrogen absorbing alloy, and which comprises a low work function material having a work function equal to or less than 3 eV,

2) an absorption part in which one surface of said structure body is exposed to a deuterium gas at a pressure,

3) a desorption part in which another surface of said structure body is exposed to the deuterium gas at a pressure lower than the pressure in said absorption part, said desorption part and said absorption part being positioned to form a closed space sealed by said structure body,

4) a high pressurization device configured to produce the pressure in said absorption part, said high pressurization device including a deuterium supply device configured to supply the deuterium gas to said absorbing part,

5) a low pressurization device configured to reduce the pressure in said desorption part, said low pressurization device including an exhaust gas device configured to evacuate said desorption part,

6) a transmutation material binding device configured to bind a material that undergoes nuclide transmutation on said one surface of said structure body, and

7) a heating device that controls the temperature of the structure body.

Claim 1 further defines that the high pressurization device and the low pressurization device are configured to provide a flow of the deuterium that penetrates through the structure body and the material bound on the structure body.

By providing such a high pressurization device and a low pressurization device, the structure body readily absorbs the deuterium gas and produces an effective nuclide transmutation between the deuterium gas and the material provided on its surface.

The amendments are supported by the original disclosure of the present application.¹

¹ For example, see specification, pages 14 and 16.

Regarding the rejections under 35 U.S.C. §101 and §112, first paragraph:

M.P.E.P. § 2107.02 states as follows:

“[T]he applicant does not have to provide evidence sufficient to establish that an asserted utility is true “beyond reasonable doubt.” *In re Irons*, 340 F.2d 974, 978, 144 USPQ 351, 354 (CCPA 1965). Nor must an applicant provide evidence such that it establishes an asserted utility as a matter of statistical certainty. *Nelson v. Bowler*, 626 F.2d 853, 856-57, 206 USPQ 881, 883-84 (CCPA 1980) Instead, *evidence will be sufficient if, considered as a whole, it leads a person of ordinary skill in the art to conclude that the asserted utility is more likely than not true.*” (Emphasis added in italic)

M.P.E.P § 2107.02 also states as follows:

“Where an applicant has specifically asserted that an invention has a particular utility, that assertion cannot simply be dismissed by Office personnel as being “wrong,” even when there may be reason to believe that the assertion is not entirely accurate. Rather, Office personnel must determine if the assertion of utility is credible (i.e., whether the assertion of utility is believable to a person of ordinary skill in the art based on the totality of evidence and reasoning provided). An assertion is credible unless (A) the logic underlying the assertion is seriously flawed, or (B) the facts upon which the assertion is based are inconsistent with the logic underlying the assertion.”

In the Response filed April 28, 2004, Applicants submitted Exhibits A-C to show the assertion of utility, i.e., operability, of the claimed devices. However, in the Office Action dated July 7, 2004, the rejections under 35 U.S.C. §101 and §112, first paragraph, were maintained simply by stating that “the present inventors contributed to all of the exhibits” and that “[i]f reproducibility only occurs in one’s own lab, errors (such as systematic errors) would be suspect.” As noted in Applicants’ April 28, 2004 Response, along with Exhibit A published by the present inventors, Exhibit B shows a study conducted and authored by two other researchers, and Exhibit C shows a replication study conducted and authored by three university researchers at Osaka University together with only one of the inventors.

Accordingly, it is respectfully re-submitted that the reproducibility did not occur only in “one’s own lab,” and that Applicants’ assertion of utility cannot be dismissed without any

“logic underlying the assertion is seriously flawed” or “facts upon which the assertion is based are inconsistent with the logic underlying the assertion” or simply because the Examiner only suspects “systematic errors” based on the co-authorships in the studies of Exhibits A-C.

Moreover, as stated in the previously filed Requests for Suspension of Action, the U.S. Naval Research Laboratory (NRL) started on May 20, 2005 a cooperative research with Mitsubishi Heavy Industries, Ltd. concerning Applicants’ nuclide transmutation technique.. However, the research has not been completed yet, and Applicants cannot provide at this time technical data of the NRL effort.

Nonetheless, the following exhibits and explanations are submitted for the examiner’s consideration..

(1) Exhibit 1: “Elemental analysis of Pd Complexes: Effects of D₂ gas permeation”, Jpn. J. Appl. Phys, Vol. 41 (2002) pp. 4642-4650

Exhibit 1 is written by one of the present inventors, Mr. Yasuhiro Iwamura and two other colleagues. Exhibit 1 clearly proves the effect of the present invention. Fig. 2(a) of Exhibit 1 discloses a structure body comprising a palladium substrate of 0.1 mm, a mixture layer of 1000 angstroms consisting of CaO and Pd layers alternatively laminated, a thin Pd film of 400 angstroms. CaO has a work function of 1.6-1.86 eV which is lower than 3 eV. The work function of Pd (4.99 eV). Cs or Sr is deposited on the surface of the thin Pd layer. This example corresponds to the structure body presently defined in Claims 1 and 16.

Fig. 3(a) of Exhibit 1 shows an experimental apparatus also in accordance with the presently claimed invention. In this apparatus, a deuterium gas of relatively high pressure (1.0 atm) is applied to the Cs/Sr-deposited surface of the structure body, and the opposite surface of the structure body is evacuated, so as to provide a flow of the deuterium that penetrates through the structure body and the material provided on the structure body.

According to this example, Cs was transmuted to Pr as shown in Fig. 4(a), and Sr was transmuted to Mo as shown in Fig. 7(a). Figs. 5(a) and 8(a) indicate that transmutation did not occur in the case where the CaO/Pd mixture layer was omitted from the structure body. Furthermore, Fig. 5(b) indicates that transmutation did not occur in the case where hydrogen gas was used instead of deuterium gas. These results show that the device of Claims 1 and 16 can generate nuclide transmutation by utilization of the claimed low work function material and deuterium gas.

Furthermore, the after-mentioned Exhibits 2 and 3, to which the present inventors *are not related*, recite the Exhibit 1 as a first citation in a positive manner. In particular, Exhibit 2 states that “The phenomenon has been observed with good reproducibility” regarding the nuclear transmutation according to Exhibit 1, and it is clear that Dr. Yamada of Iwate University evaluated high reproducibility of condensed nuclear transmutation according to Exhibit 1. As is explained above, the reproducibility of condensed nuclear transmutation according to Exhibit 1 has been positively evaluated in this field of the art.

(2) Exhibit 2: “Producing transmutation element on multi-layered Pd sample by deuterium permeation”, the 12th International Conference on Condensed Matter Nuclear Science, 2005, Yokohama, Japan.

The present inventors *are not associated* with Exhibit 2. Exhibit 2 describes that nuclear transmutation was generated by an apparatus in accordance with the presently claimed invention. The apparatus of Exhibit 2 used samples consisting of a Pd foil of 0.1 mm, a CaO layer of 2 nm formed on the Pd foil, and a thin Pd layer of 40 nm formed on the CaO layer, and Cs was deposited on the thin Pd layer. A deuterium gas of 0.1 MPa was applied to the Cs-attached surface of the samples, and opposite surfaces were evacuated. The samples were heated at 70°C by a heater. Under these conditions, deuterium gas was passed through the samples, and the results shown in Figs. 10 and 11 of Exhibit 2 were obtained.

The graphs of Figs. 10 and 11 of Exhibit 2 indicate extraordinary peaks at mass numbers 135 and 137, and the generation of such peaks could not be explained as contamination. Exhibit 2 concluded that the extraordinary peaks suggest the generation of ^{137}La and ^{137}Ba , and that they are intermediates leading to ^{141}Pr .

Therefore, Exhibit 2 proves the effects of present Claims 1 and 16.

(3) **Exhibit 3:** “In situ accelerator analysis of palladium complex under deuterium permeation”, the 12th International Conference on Condensed Matter Nuclear Science, 2005, Yokohama, Japan.

The present inventors *are not associated* with Exhibit 3. The apparatus used in Exhibit 3 differs from the apparatus defined in Claims 1 and 16 in some regards. In the apparatus of Exhibit 3, Sr was deposited on a surface of a Pd foil, a CaO layer was formed on the Sr-deposited surface of the Pd foil. The Sr-deposited surface was evacuated, and a deuterium gas was supplied to the opposite surface. That is, the order of the layers and the direction of deuterium in the sample are different from those presently claimed.

However, even in the apparatus of Exhibit 3, transmutation of Sr to Mo was observed as shown in Figs 4(a) and 4(b).

Although Exhibit 3 cannot directly prove the effects of the present invention, it is clear that nuclear transmutation can be generated by providing a flow of deuterium through a structure body comprising a Pd layer, a low work function material, and transmutation material.

(4) **Exhibit 4:** Front page of “Condensed matter nuclear science”

Exhibit 4 indicates that the contents of Exhibits 2 and 3 were presented in Yokohama, Japan, between November 27 and December 2, 2005.

(5) Exhibit 5: “Transmutation reactions induced by D2 gas permeation through Pd complexes (Pd/CaO/Pd)”, 14th International Conference on Condensed Matter Nuclear Science, August 10-15, 2008

Exhibit 5 is a document presented by the present inventors, Mr. Yasuhiro Iwamura and Mr. Takehiko Itoh, in 14th International Conference on Condensed Matter Nuclear Science, held in Washington DC, USA on August 10-15, 2008. Exhibit 5 explains nuclear transmutation reaction using various data obtained by an apparatus according to the present invention.

As shown in Exhibit 5, in recent scientific societies regarding condensed nuclear transmutation, there is no doubt about the possibility of nuclear transmutation, and main issues argued in the society is the mechanism of generating nuclear transmutation. That is, it has become accepted in the scientific community that nuclear transmutation can occur under particular conditions.

The structure body used in Exhibit 5 is a Pd substrate of 0.1 mm, a mixture layer of 1000 angstroms consisting of CaO layers and Pd layers alternatively laminated on the Pd substrate, and thin Pd layer of 400 angstroms formed on the mixture layer, and Cs or Sr is deposited on the thin Pd layer. In the apparatus of Exhibit 5, deuterium gas of relatively high pressure (1 atm) was supplied to Cs/Sr deposited side of the structure body, and the opposite side was evacuated to provide a flow of deuterium through the structure body and the transmutation material. As a result, as shown on pages 5-12 of Exhibit 5, Cs was transmuted to Pr, and Sr was transmuted to Mo.

Furthermore, as shown on pages 15-22 of Exhibit 5, nuclear transmutation reaction was not uniformly observed in the Cs/Sr deposited area, but observed at several locations in the Cs/Sr deposited area. In this way, although the reproducibility of the present invention is

not 100% and the mechanism is not clear even now, the generation of nuclear transmutation has been proved under the conditions recited presently in Claims 1 and 16.

(6) **Exhibit 6:** Agenda of “14th International Conference on Condensed Matter Nuclear Science” and the abstract of Exhibit 5 therein

(7) **Exhibit 7:** “Low energy nuclear transmutation in condensed matter induced by D₂ gas permeation through Pd complexes: correlation between deuterium flux and nuclear products”, 10th International Conference on Cold Fusion, 2003, Cambridge, MA: LENR-CANR.org.

Although Exhibit 7 is written by the present inventors, Exhibit 7 also proves the effect of the present invention. Figs. 1(a) and (b) of Exhibit 7 discloses a structure body comprising a palladium substrate of 0.1 mm, a mixture layer of 1000 angstroms consisting of CaO and Pd layers alternatively laminated, a thin Pd film of 400 angstroms. CaO has a work function of 1.6-1.86 eV which is lower than 3 eV and the work function of Pd (4.99 eV). Cs or Sr is deposited on the surface of the thin Pd layer. This example corresponds to the structure body in the present Claims 1 and 16.

Fig. 11 of Exhibit 7 is a graph showing a correlation between D₂ permeation rate and conversion rate of Cs. The conversion rate of Cs increases up to about 90% as D₂ permeation rate increases.

Thus, as is explained by Exhibits 1 to 7, the generation of nuclear transmutation has been proved under the conditions recited presently in Claims 1 and 16. Therefore, Claims 1 and 16 cannot continue be rejected based on 35 USC § 101 and 35 U.S.C. §112, first paragraph.

Applicants therefore respectfully request that the rejections under 35 U.S.C. §101 and 35 U.S.C. §112, first paragraph, be withdrawn.

Regarding the rejection under 35 U.S.C. §112, second paragraph: Applicants address the rejection as follows.

With regard to Claim 1, the Office Action asserts that “[t]he omitted element is: a heater ... requires to initiate the alleged transmutation reaction” and that “[w]ithout said heater the alleged reaction never takes place.” Nevertheless, nowhere does Applicants’ specification state that such a heater is required or essential. Instead, Applicants’ specification on page 18 simply provides an exemplary embodiment of the nuclide transmutation device according to one embodiment of the present invention. Nevertheless, in an effort to advance prosecution, Claim 1 presently recites a heating device that controls the temperature of the structure body.

The Office Action has further asserted that the claims should be restricted to materials that undergo nuclide transmutation. The claims do recite “a transmutation material binding device configured to bind a material that undergoes nuclide transmutation on said one surface of said structure body.” The specification discloses working examples in which nuclide transmutations of i) Cs to Pr, ii) C to Mg, Mg to Si, and Si to S, iii) Sr to Mo, and iv) Na to Al, were observed. According to the Applicant's work, the transmutation materials applicable to the present invention include at least alkali metal elements, alkaline-earth metal elements, transition metal elements, and metalloid elements. Indeed, the examiner’s attention is invited to M.P.E.P. § 2173.04, which states:

Breadth of a claim is not to be equated with indefiniteness. *In re Miller*, 441 F.2d 689, 169 USPQ 597 (CCPA 1971). If the scope of the subject matter embraced by the claims is clear, and if applicants have not otherwise indicated that they intend the invention to be of a scope different from that defined in the claims, then the claims comply with 35 U.S.C. 112, second paragraph.

Thus, based on this explanation, Claims 1 and 16 are not indefinite with respect to setting forth a definition of a transmutation material binding device.

Furthermore, the Office Action asserts that “claim 5 should be incorporated into claim 1” because “the transmutation material in question is not actively claimed.” However, Claim 5 simply specifies, i.e., further details, the structure of the transmutation material binding device. Moreover, in a case where the transmutation material is bound to a surface, the present invention will perform transmutation of that material. There is no element set forth in Claim 1 for a continuously operating transmutation process. Thus, Claim 1 is believed to be definite.

With regard to the terms “high pressurization device” and “low pressurization device” recited in Claims 1 and 16, it is clear from each claim that high pressurization device produces a pressure in the absorption part higher than the pressure of the desorption part reduced by the low pressurization device. Therefore, these terms are also definite.

Thus, for all these reasons, the 35 U.S.C. §112, second paragraph, rejection should presently be withdrawn.

Regarding the art rejections: M.P.E.P. § 2131 requires for anticipation that each and every feature of the claimed invention must be shown in as complete detail as is contained in the claim. M.P.E.P. § 2123 I states that a reference may be relied on for all it would have reasonably suggested to one having ordinary skill in the art, including non-preferred embodiments. M.P.E.P. § 2143.03 requires that all words in a claim must be considered in judging the patentability of the claim against the prior art.

In the present invention, as recited in Claims 1 and 16, the structure body and the transmutation material are exposed to deuterium gas at the absorption part. Because gaseous deuterium contacts the structure body and the transmutation material, the amount of a flow of deuterium penetrating through the structure body and the transmutation material is large, it is possible to improve the transmutation efficiency.

Iwamura shows in Fig. 2 a multi-layered cathode consisting of a palladium plate, a complex layer which is made of palladium and CaO on the palladium plate, and a palladium film formed on the complex layer. However, in the apparatus of Iwamura, as shown in Fig. 1, an electrolysis device is provided on the multi-layered cathode, and bubbles of deuterium are generated from the surface of the multi-layered cathode by electrolyzing heavy water. Therefore, the apparatus of Iwamura cannot expose the surface of the structure body and the transmutation material to deuterium gas of a high concentration, and the apparatus of Iwamura lacks the feature of Claims 1 and 16 that “an absorption part in which one surface of said structure body is exposed to a deuterium gas at a pressure”. Therefore, in the apparatus of Iwamura, it is difficult to increase the amount of deuterium flowing through the multi-layer cathode as much as that in the present invention.

Furthermore, in the apparatus of Iwamura, a transmutation material is ***not bound*** on the surface of the multi-layer cathode. Therefore, the apparatus of Iwamura does not anticipate or make obvious the feature of the present Claim 1 that “a transmutation material binding device configured to bind a material that undergoes nuclide transmutation on said one surface of said structure body”, nor does it anticipate or make obvious the feature of the present Claim 16 that “the structure body having one surface on which a material that undergoes nuclide transmutation is provided.”

As explained above, because the apparatus of Iwamura does not have the features defined in Claim 1 or Claim 16, presently amended Claims 1 and 16 are not anticipated by the description of Iwamura.

Sakano discloses, as shown in Fig. 4 thereof, a hydrogen gas purification membrane consisting a palladium substrate 16, a CaO-Pd mixture layer 17 formed on the palladium substrate 16, and a thin palladium layer 18. However, as shown in Fig. 1 of Sakano, this hydrogen purification membrane is used only for producing a pure hydrogen gas by filtering

only hydrogen gas from a raw material gas containing hydrogen gas, and Sakano is completely silent about deuterium gas.

Furthermore, Sakano does not disclose nor suggest a structure in which transmutation material is bound on the surface of the hydrogen purification membrane, as presently defined.

Therefore, the present Claims 1 and 16 are not anticipated or made obvious by Sakano.

As explained above, because what Sakano describes is only purification of hydrogen gas, there is no motivation for a person skilled in the art to combine the hydrogen gas purification membrane of Sakano with the electrolyzer of Iwamura. Even if the element of Sakano were to be combined with Iwamura, there is no disclosure or suggestion or rationale to use a deuterium gas for electrolysis or to bind a transmutation material on a structure body at a side of high-pressure deuterium gas.

Therefore, the present Claims 1 and 16 are not obvious over the combination of Iwamura and Sakano. Furthermore, since Claims 4-6, 10, and 12-15 depend on Claim 1, substantially the same arguments set forth above also apply to these dependent claims. Therefore, Claims 4-6, 10, and 12-15 are believed to be allowable as well.

Hence, for at least the foregoing reasons, Claims 1 and 16 (and the claims dependent therefrom) are in condition for allowance.

Lastly, Applicants respectfully request acknowledgement of two IDS references, DE19649511 (AO) and DE4009604 (AP), as listed on the PTO 1449 form filed on March 29, 2004 and as presently resubmitted. English language abstracts of these references are submitted herewith.

In view of the amendments and discussions presented above, Applicants respectfully submit that the present application is in condition for allowance, and an early action favorable to that effect is earnestly solicited.

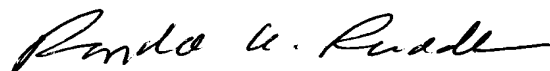
Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.

Customer Number

22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 08/03)



Gregory J. Maier
Attorney of Record
Registration No. 25,599

Ronald A. Rudder
Registration No. 45,618

GJM/RAR/mda

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